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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/776,672	02/11/2004	Elizabeth G. Pavel	7608	3482

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MOSER IP LAW GROUP / APPLIED MATERIALS, INC.  
1040 BROAD STREET  
2ND FLOOR  
SHREWSBURY, NJ 07702

EXAMINER
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TRAN, BINH X

ART UNIT	PAPER NUMBER
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1765

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	02/21/2007	PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

# Office Action Summary

Application No.

10/776,672

Applicant(s)

PAVEL ET AL.

Examiner

Binh X. Tran

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 28 November 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1, 2, 6, 7, 9, 14, 16, 17, 21, 22, 28 and 30-45 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-2, 6-7, 9, 14, 16-17, 21-22, 28, 30-45 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 1, 7, 9, 16, 21-22, 31-45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishihara (US 2001/0027023 A1) in view of Powell et al. (US 2002/0135761 A1).

Respect to claims 1 and 16, Ishihara discloses a method for removing/etching photoresist layer (organic layer, paragraph 0116) comprising the step of:

position the substrate comprising a photoresist layer into a processing chamber  
(See Fig 1);

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removing the photoresist layer using a plasma (paragraph 0119-0135);  
monitoring the plasma for byproduct hydrogen optical emission, CO optical emission, or  
by reagent oxygen optical emission during the process (paragraph 0135-0136).

terminate the removing process according to the intensity result of emission peak  
wavelength of byproduct hydrogen or reagent oxygen

Ishihara does not explicitly disclose monitoring the plasma for both reagent and  
byproduct optical emission and stopping the etching upon the byproduct optical  
emission obtain a first level and the reagent optical emission obtaining a second level.  
However, Ishihara clearly measure the intensity of light emission of hydrogen (i.e. by  
product), oxygen (reagent), CO, or the like (paragraph 136). In paragraph 135, Ishihara  
discloses the monitoring the emission of CO and hydrogen, or oxygen (O) and using the  
information from the monitoring to control the switching time. Powell teaches to monitor  
the optical emissions of the plasma at plurality of wavelength including hydrogen  
emission and oxygen emission and stopping the etching process base on the optical  
emission of hydrogen and oxygen gas (paragraph 0030, 0036, 0041, 51 fig 11). It  
would have been obvious to one having ordinary skill in the art, at the time of invention,  
to modify Ishihara in view of Powell by monitoring plurality of optical emission including  
both hydrogen and oxygen emission and stopping the etching process based on the  
optical emission of both signal because this will result in a more accurate endpoint and  
help us to evaluate the progression of the plasma recipe. Further, Ishihara clearly  
disclose it is possible to monitor plurality of emission at the same time in order to control  
the endpoint (i.e. switching time).

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Respect to claim 35, Ishihara discloses a method for removing/etching photoresist layer (organic layer, paragraph 0116) comprising the step of:

position the substrate comprising a photoresist layer into a processing chamber (See Fig 1);

etching the photoresist layer using a plasma (paragraph 0119-0135);

determining an endpoint by monitoring the plasma for a reagent optical emission of oxygen or a byproduct optical emission of hydrogen (paragraph 0135-0136).

Ishihara fails to explicitly disclose the step of determining an early endpoint and final endpoint by monitoring plasma reagent optical emission and byproducts optical emission. However, Ishihara clearly teaches to monitor reagent optical emission (oxygen emission) or byproduct emission (hydrogen emission). Powell teaches to monitor the optical emissions of the plasma at plurality of wavelength including oxygen emission (early endpoint) and hydrogen emission (final endpoint) and stopping the etching process base on the optical emission of oxygen (read on early endpoint) and hydrogen gas (read on final endpoint) (paragraph 0030, 0036, 0041, 51, 0053fig 11). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Ishihara in view of Powell by monitoring both early endpoint and final endpoint because this will result in a more accurate endpoint and help us to evaluate the progression of the plasma recipe.

Respect to claims 7, 21 and 36, Ishihara teaches to monitor byproduct hydrogen optical emission occurs at a wavelength of about 656 nm while etching (paragraph

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0136). Powell also teaches to monitor the hydrogen optical emission occurs at a wavelength of about 656 nm (Fig 11).

Respect to claims 9, 22 and 37, Ishihara discloses to monitor the reagent oxygen optical emission occurs at a wavelength of about 777 nm while etching (paragraph 0136). Powell also teaches to monitor the oxygen optical emission occurs at a wavelength of about 777 nm (Fig 11, paragraph 51). The limitation of claim 38 has been discussed above.

Respect to claims 31, 33, 39 Powell teaches to determine the condition of the plasma source (Fig 5-6, 9-10, paragraph 0028-0032). Respect to claims 32, 34, 40, Powell teaches to determine the condition of the interior of the processing chamber (paragraph 0051-0053).

Respect to claims 41, 44-45, Ishihara fails to disclose the step of determining from at least one of the monitored optical emissions whether a cleaning cycle is necessary, whether components within the chamber are degrading, or both. Powell teaches to use the monitored optical emissions to determine condition of the chamber (paragraph 0051-0053). According to Powell, a determination is made as to whether the chamber is clean enough. It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Ishihara in view of Powell to determine from the monitored optical emissions whether the cleaning cycle is necessary or the component within chamber are degraded (i.e. dirty) because cleaning the chamber help to reduce residues formed on the semiconductor wafer during the plasma process.

The limitation of claims 42-43 has been discussed above (See claim 35).

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4. Claims 2, 6, 14, 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishihara and Powell and further in view in view of Hallock et.al. (US 2002/0151156).

Respect to claims 2 and 17, Ishihara and Powell fail to disclose the photoresist layer comprises a harden crust layer. However, Ishihara clearly teaches to implant ion such as boron, phosphorous, arsenic into the photoresist layer. Hallock teaches implant boron, phosphorous or arsenic ion to form a harden crust layer (paragraph 0018). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Ishihara and Powell in view of Hallock by having a harden crust layer because it will prevent ion from penetrating into the surface of the substrate.

Respect to claims 6, 14, Hallock discloses the optical emission having first level during etching and second level after the crust is removed and third after the photoresist is removed (Fig 2-3).

5. Claims 28, 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishihara and Powell and further in view in view of Smith Jr. et al. (US 6,419,801).

Respect to claim 28, 30, Ishihara and Powell fails to discloses the step of comparing the monitoring optical emissions to a fingerprint of a clean chamber. However, Powell clearly teaches to use the optical emission to determine when the chamber is clean enough and to produce a desired chamber condition (paragraph 0052). Smith teaches to comparing the monitored optical emissions of a "healthy" plasma chamber in order to determine whether the chamber is in condition for cleaning (e.g. "dirty/unhealthy" plasma condition) (See col. 81, read on "comparing the monitored

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optical emissions to a fingerprint of a clean chamber"). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Ishihara and Powell in view of Smith by comparing the optical emission to the finger print of a clean chamber (i.e. "healthy plasma chamber") because it help us to determine when the chamber is need to clean base on a set of standard.

### ***Response to Arguments***

6. Applicant's arguments with respect to claims 1, 16 and 35 in page 7-8 of the remark have been considered but are moot in view of the new ground(s) of rejection.

7. The new cited prior art (Powell) clearly teaches to monitor the plasma for byproduct optical emission (hydrogen emission) and reagent optical emission (oxygen emission) during the plasma process (See Fig 11). Powell also shows that the hydrogen byproduct optical emission has the first level and oxygen reagent optical emission has the second level (See graph in Fig 11). Since each optical emission signal has different intensity (i.e. different level), it is possible to use one signal for early endpoint detection and the other signal for final endpoint detection (See Fig 11).

### ***Conclusion***

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within



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TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Binh X. Tran whose telephone number is (571) 272-1469. The examiner can normally be reached on Monday-Thursday and every other Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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*Binh Tran*

Binh X. Tran